Detailed Analysis of MMSE Scores Across Visits

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Introduction

The Mini-Mental State Examination (MMSE) is a widely used tool for assessing cognitive impairment and tracking changes in cognitive function over time. The ability to accurately measure changes in cognitive function is crucial for early diagnosis and monitoring of conditions such as dementia. This report details an analysis of MMSE scores collected during a longitudinal study that tracks the progression of cognitive abilities in patients with potential cognitive impairment.

Objective

The primary objective of this analysis is to determine whether there are statistically significant changes in MMSE scores across different visits (stages) of the study. By doing so, we aim to understand if there is a pattern of cognitive decline or improvement, which could be indicative of underlying health changes.

Methodology

Data Preparation

The dataset consists of MMSE scores from multiple visits for each subject. The data was pivoted to align the MMSE scores with the corresponding visits, labeled as 'stage_1', 'stage_2', etc. This reorganization facilitates a direct comparison of scores across different time points.

Statistical Analysis

An Analysis of Variance (ANOVA) test was conducted to compare the means of MMSE scores between stages. ANOVA was chosen for its ability to test for significant differences across multiple groups with a single test, making it ideal for our study that includes multiple visits.

Results

Descriptive Statistics

The mean MMSE scores calculated for each stage are as follows:

Mean for stage_1: 27.503
Mean for stage_2: 26.944
Grand mean: 27.224
The grand mean provides a baseline for comparison across different stages.

Distribution of MMSE Scores

Data 1: Distribution of MMSE Scores

Mean for stage_1: 27.503
Mean for stage_2: 26.944
Grand mean: 27.224
SS groups: 22.378

Data 1 shows the frequency distribution of MMSE scores at two different stages. The distribution gives us a visual sense of where the majority of scores lie and how they spread around the mean.

ANOVA Analysis

The sum of squares for the groups (SS groups) was 22.378. The within-groups sum of squares (SSw), which represents variance within each stage, was significantly higher at 3353.301.

The ANOVA analysis yielded the following:

MS groups: 22.378
MS error: 23.45
F-statistic: 0.954
The mean squares within groups (MS error) was slightly higher than the mean squares between groups (MS groups), as shown in Data 2.

Data 2: ANOVA Summary

MS groups: 22.378
MS error: 23.45
F-statistic: 0.954
DF groups: 1, DF error: 143

Degrees of freedom for groups (df_groups) and error (df_error) were also calculated, which are necessary for determining the validity of the F-statistic.

Discussion

The calculated F-statistic is critical for interpreting the ANOVA results. It tells us whether the variability between group means is greater than would be expected by chance. In this case, the F-statistic of 0.954 suggests that there is not a statistically significant difference between the MMSE scores from the first to the second visit. If this statistic were higher, it might indicate a more substantial difference in cognitive function between visits that could be due to treatment effects, disease progression, or other factors.

Conclusion

This analysis of MMSE scores across different stages in a longitudinal study suggests that there may not be significant differences in scores between visits. However, this conclusion is tentative until further analysis, including a full p-value calculation and possibly more data, is conducted. Additionally, further analysis with post-hoc tests could provide insights into pairwise comparisons between individual visits if the overall test were significant.

The results of this study have important implications for clinical practice and research into cognitive impairment. Continuous monitoring and rigorous analysis of cognitive scores are crucial for understanding disease progression and the effects of interventions.